

5 **Claims**

1. A catalyst for the selective front-end hydrogenation of acetylene comprising

an inorganic support, a palladium metal source, and a thallium metal source, wherein the palladium metal source comprises from about 0.001 to about 2 weight percent, and the thallium metal source comprises from about 0.001 to about 1 weight percent, wherein the weight percentages are based on the total weight of the catalyst, including the palladium and thallium, and wherein the concentration of palladium metal is not less than the concentration of thallium metal.

2. The catalyst of Claim 1 wherein at least about 90 percent of the palladium metal source is concentrated within about 250 microns of a surface of the catalyst.

3. The catalyst of Claim 1 wherein the inorganic support is selected from the group consisting of alpha alumina, zinc oxide, nickel spinel and other low surface area catalyst support materials, and mixtures thereof, with a surface area less than about 100 m²/g.

4. The catalyst of Claim 1 formed in the shape of a sphere, trihole trilobal, monolith, pellet, ring or tablet.

5. The catalyst of Claim 1 wherein the support material has a BET surface area in the range of about 1 to about 100 m²/g.

5 6. The catalyst of Claim 1 wherein the support material has a pore volume in the range of about 0.2 to about 0.7 cc/g.

 7. The catalyst of Claim 1 wherein the palladium metal comprises from about 0.005 to about 0.05 weight
10 percent of the catalyst, based on the total weight of the catalyst, including the palladium metal.

 8. The catalyst of Claim 1 wherein the palladium metal comprises from about 0.01 to about 0.03 weight
15 percent of the catalyst based on the total weight of the catalyst, including the palladium metal.

 9. The catalyst of Claim 1 wherein the thallium metal comprises from about 0.001 to about 0.01 weight
percent of the catalyst based on the total weight of the catalyst, including the thallium metal.

20 10. The catalyst of Claim 1 wherein the ratio of the palladium metal to the thallium metal is from 1:1 to about 100:1.

 11. The catalyst of Claim 1 wherein the ratio of the palladium metal to the thallium metal is from about 5:1 to
25 about 50:1.

 12. The catalyst of Claim 1 wherein the ratio of the palladium metal to the thallium metal is from about 10:1 to about 20:1.

 13. A process for the manufacture of a catalyst for
30 the selective hydrogenation of acetylene comprising
 preparing a low surface area catalyst support,

5 impregnating the catalyst support with a
palladium metal source, wherein the palladium metal source
is selected from the group consisting of palladium salt
and metallic palladium, and

 impregnating the palladium-impregnated catalyst
10 support with a thallium metal source, wherein the thallium
metal source is selected from the group consisting of a
thallium salt and metallic thallium, wherein the
concentration of the thallium metal does not exceed the
concentration of the palladium metal.

15 14. The process of Claim 13 wherein the depth of
penetration of the palladium metal source into the
catalyst support is wherein about 90 percent of the
palladium is present within about 250 microns of the
surface of the catalyst material.

20 15. The process of Claim 13 wherein the ratio of the
palladium metal to the thallium metal, calculated as
elemental metals, is from 1:1 to about 100:1.

 16. The process of Claim 13 wherein the ratio of the
palladium metal to the thallium metal calculated as
25 elemental metals, is from about 5:1 to about 50:1.

 17. The process of Claim 13 wherein the ratio of the
palladium metal to the thallium metal calculated as
elemental metals, is from about 10:1 to about 20:1.

 18. The process of Claim 13 further comprising
30 reducing the catalyst by heating the catalyst in a
reducing furnace under a reducing gas.

5 19. The process of Claim 18 wherein the reducing gas
is selected from hydrogen, carbon monoxide or mixtures
thereof.

 20. A process for the selective acetylene
hydrogenation in a front-end ethylene purification process
10 comprising

 preparing the palladium/thallium catalyst of
Claim 1,

 passing a feed stream comprising methane,
ethylene, hydrogen, carbon monoxide and acetylene over the
15 catalyst.

 21. The process of Claim 21 wherein the amount of
the acetylene contained in the feed stream is reduced to
less than about 1 ppm.